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What is This?

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COGNITIVE STYLES: WHAT ARE THEY?

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An attempt was made to determine whether the traits known as cognitive styles, which have been variously interpreted, could be brought under a single broad concept. An examination of the evidence showed that most of those traits could be related to the writer's structure of intellect, in one way or another. It is not yet clear whether they should be recognized as intellectual abilities or intellectual controls, or both. A few seem more identifiable with traits of interest or of temperament. It was suggested that the structure-of-intellect model could serve as a frame of reference for future research in this area.

Common Conceptions of Cognitive Styles

IT is generally agreed that what writers call "cognitive styles" are in the general family of personality traits, where traits are commonly conceived as variables or dimensions along which individuals of a population differ. Beyond that, there are many variations in conceptions. Some of the differences are reflected in the labels given to cognitive styles by various writers.

Some Alternative Terms for the Class

Although "styles" is the term most commonly applied, as in the title of this paper, some prefer the label of "cognitive controls." Among them are Broverman (1960a), Santostefano (1969), and Wachtel (1972). Other writers have spoken of "cognitive attitudes" (Gardner, 1953), a term that this writer once adopted (Guilford, 1967), but for

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reasons which will develop he has outgrown. This view, in effect, makes a cognitive style a matter of personal preference among steps and other aspects of mental functioning. Holzman and Gardner (1959) have used the expression "cognitive system principles."

In a historical treatment of the subject, Vernon (1973) has pointed out that the traits under discussion are like the personality types of old. Another view (Messick, 1976) speaks of cognitive strategies, which he would probably limit to very general approaches in mental functioning, independent of incidental demands. A unique view of Broverman (1960b) suggests that a cognitive style is a profile of mental abilities, and it is best detected by means of ipsative scores.

Some authors give more expanded descriptions of the nature of cognitive styles. Santostefano (1969) states that those traits determine the amount and organization of information available to the individual at the moment. A style is activated by certain classes of information. It mediates the influence of other traits of personality and motivation on intellectual functioning.

Messick (1976) adds to the picture by comparing cognitive styles with abilities, contrasting them and relating them. Abilities are unipolar traits while styles are bipolar. Abilities are narrower in scope. Abilities are measured in terms of *level* of performance, where styles are measured by degree of some *manner* of performance. Values are attached to levels of ability but not to degrees of cognitive styles. Styles exert controls on mental functioning; abilities do not. The two kinds of traits are not antithetical in all respects, however. As will develop in this paper, there are some exceptions to these specifications.

Kogan (1976) is more explicit on the difference in the ways the two kinds of traits are measured. He points out that there are three levels of difference in measurement involved. At the one extreme, for abilities, the trait is measured in terms of accuracy of performance, and psychological values are implied by the scores. At the middle level, accuracy is not a criterion, but high scores have more value. He regards traits of fluency and flexibility, and by inference all divergent-production abilities, as being at the second level—values apply but accuracy does not. Kogan evidently forgets, however, that criteria other than accuracy are commonly applied in tests of ability—speed and quantity of output, for example. This consideration would put tests of fluency and flexibility, and all divergent-production abilities, back in the ability category, thus losing Kogan's "half-way house."

All these disparities in labels and conceptions call for an attempt to develop some kind of consensus, if that is possible. That is what this paper is primarily about.

Cognitive Styles as Intellectual Executive Functions

A new general view can be suggested regarding cognitive styles. We can think of them as functions as well as traits. When established abilities or other traits are demonstrated by factor analysis, the approach starts with data in terms of individual differences, and the resulting traits are in that same context. When we make a translation to the context of the functioning individual, a well-established trait should imply a unique kind of function. In the latter context we are dealing with modes of operation, or functions.

It is suggested that the label "intellectual," mentioned in the heading above, should be substituted for "cognitive," in accordance with the writer's structure-of-intellect (SI) model (Guilford, 1967, 1977a). Although "cognitive" style agrees with the larger concept of "cognitive psychology," cognition is only one of five major operations of the SI model. Most writers on cognitive styles do often say that these traits apply also to memory, thinking, and problem solving, which brings into the picture all the other SI kinds of operations.

As for the explanation of the proposed "executive" modifier, that term comes from a rather incidental finding in a factor-analytic study of divergent-production abilities in the area of behavioral information (Hendricks, Guilford, and Hoepfner, 1969). A large number and variety of tests intended to determine how fluent, flexible, and original the subjects could be in producing behavioral items of information had been developed in printed form. It was wondered whether the same abilities could also be found represented in tests requiring *S* to produce voluntary facial and vocal expressions. It turned out that there was a facial-expression factor and a vocal-expression factor, distinct from each other and from all factors for the printed tests. It has been suggested that these two expressive factors represent two executive functions—functions that have to do with the initiation and control of motor activity in certain muscle groups (Guilford, 1967, 1972).

A more recent thought has been that if there are executive functions involved in the initiation and control of motor activity, there could also be executive functions governing intellectual functioning. Besides being in possession of intellectual functions, an individual needs some guiding functions that determine when and where, and in what manner, those functions are utilized. Those writers who have emphasized the control aspect of cognitive styles come close to this conception. Thus, "cognitive-control" functions become "intellectual executive functions."

In the discussions that follow, however, the label "cognitive styles" will be generally used, because it is traditional and, as will be concluded, not all of the personality dimensions of this sort do quality for the caption of "intellectual executive functions." The important objective of this paper is to show that most of the cognitive styles bear apparent relations to certain aspects of the structure-of-intellect model. The paper is not intended as a comprehensive review of the subject of cognitive styles, so there is some selective attention involved.

Research on Cognitive Styles

In his recent review of reported cognitive-style variables, Messick (1976) lists no less than 19 such traits. Before seeking possible logical connections between such variables and structure-of-intellect categories, it is desirable to consider the question of construct validity of those variables, as a basis for evaluations. Some of the cognitive styles have been more than amply supported by repeated research, while some others have less replicative support.

For the discovery of such variables by the use of measures of individual differences, the natural course would be through factor analysis. Some investigators have used correlation coefficients only, stopping short of factor analysis, which leaves more uncertainties. But some of the factor analyses have had shortcomings because they were not well planned or well executed. Sometimes the samples of subjects have been very small. The selection of experimental variables for analysis was also sometimes short of ideal. For example, variables have sometimes been experimentally interdependent, either because some were merely near-alternate forms of others, or some tests were just scored in different ways. Despite such limitations, most reported styles were given attention for any possible light they may have to offer.

Some investigators have pointed out that not enough attention has been paid to "intelligence"; for example, not attempting to hold ability or abilities constant while investigating what were commonly regarded as nonaptitude traits. The term is in quotation marks because the traditional concept, which was almost exclusively involved, is very ambiguous and very limited in its coverage of intellectual abilities. Investigations could have proceeded with much greater clarity if SI categories and abilities had been given attention, as later discussions will show. There were one or two exceptions in which SI abilities were taken into account.

Best Established Cognitive Styles

Field Independence versus Field Dependence

Of all the cognitive styles, by far the most investigated has been Witkin's Field Independence versus Field Dependence. For the sake of brevity, this trait will be referred to hereafter as simply FI.

The origin of this variable came incident to investigations of perception of visual space. In one task, *S* was to adjust a rod seen within a rectangular frame, each tilted away from the true vertical, until it seemed to him to be vertical. This task became the Rod and Frame Test (RFT). In another task, *S* was to adjust the tilt of his chair to the true vertical position, while looking into a small tilted room. This became the Body Adjustment Test (BAT). The most relevant aspect of this research was that large individual differences in scores (measures of departures of adjustments from the true vertical) were found and also that individuals were self-consistent in their scores over time (Asch and Witkin, 1948).

Witkin later found that his two vertical-adjustment tests correlated substantially with an Embedded Figures Test (EFT). Over the years, a few analyses have verified a factor with the three tests, RFT, BAT, and EFT, in common. An EFT test presents relatively complex visual figures, with *S* to find given simple figures incorporated as parts. The common feature of all three tests is that *S* is to arrive at a correct perception by ignoring interfering contexts—visual appearance of the rectangle and of the room in the two adjustment tests and the irrelevant additions in the EFT.

The common interpretation of the FI trait has emphasized cognitive analysis or articulation as the basic quality; a tendency to analyze rather than to leave items of information global and perhaps confused (Witkin, 1965, 1976). The person high on FI is said to seek differentiated information, with well-distinguished parts. A person low on FI is thought to be more likely to have "fused" experiences, perhaps with inability to separate items of information from their contexts.

Extensive research has led to conclusions regarding relationships of FI to many aspects of behavior. The trait is said to apply well beyond the visual sphere in which it was first discovered. In problem solving, individuals low in FI are reported to have difficulty in restructuring problems and also in using an element in new and different ways. In social behavior, according to Witkin (1976), the person low in FI is likely "to use the prevailing frame of reference to define his attitudes, beliefs, and his feelings, and even his self view." This greater attention to his social environment is said to have the effect of developing his abilities to deal with people, or in structure-of-intellect terms, his behavioral abilities. In other areas of personality, the person high in FI has more independent opinions and he dislikes system and routine (Pemberton, 1952).

Individuals having more extreme positions on the FI continuum show certain general consequences in behavior, as in vocational and educational choices (Witkin, 1976). Those low in FI are likely to prefer the social sciences and social vocations, such as clinical psychology or nursing. Those high in FI are likely to prefer natural sciences, engineering, and mathematics. Those at the extremes show different styles in teaching and in approaches to learning (Witkin, 1976). Some of these characteristics that bear relations to FI help to throw light on its basic nature, as will be pointed out.

An Alternative View of Field Independence

This writer's own view of the nature of FI is that it is a matter of flexibility rather than analysis. It is a readiness to make changes in information, an ability or an inclination (or both) to effect transformations (one kind of SI product, or item form in which information occurs, in the SI model). Witkin himself sometimes refers to FI as an ability. If it is an ability, we should look elsewhere for more direct evidence that it is an ability to analyze. Such evidence seems lacking. In a large factor-analtyic study of abilities related to creative thinking, in the Aptitudes Research Project at the University of Southern California, an ability to analyze was hypothesized. Included in the test battery for factor analysis were four especially designed tests, each requiring some kind of analysis. The four tests scattered on different factors.

On the other hand, there is positive evidence that flexibility is involved in characteristic tests of FI. The Embedded Figures Test is very similar to the ARP's Hidden Figures test, both being based on the Gottschaldt figures. Hidden Figures has consistently helped to demonstrate the SI factor of NVT (convergent production of visual transformations).[1]

For some indirect evidence, Witkin and others report a rather consistent sex difference in FI, males scoring a bit higher. In ARP research the same kind of differences was found in divergent-production tests involving transformations. It can be said that Witkin's body-adjustment tests of FI involve transformations away from illusory perceptions toward correct perceptions of the vertical. The facts, mentioned earlier, that Low-FI persons have difficulty in restructuring problems and in using items of information in new ways, also suggests flexibility rather than analysis.

In fairness to Witkin, it should be said that he has recognized a relation between FI and flexibility, but he has continued to prefer the analytical interpretation (Witkin, Dyk, Faterson, Goodenough, and Karp, 1974). Because it is found that as children grow older they tend more toward the FI end of the scale, Witkin has developed an elaborate theory of development that rests on the concept of differentiation, a favorite Gestalt-psychology genetic principle. It is possible, however, that improvement in FI with age indicate rather some natural gains in transformation abilities, NVT in particular. This conclusion would not necessarily invalidate the differentiation theory of development, for which other evidence is given.

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[1] In the most recent version of the *SI* model (Guilford, 1977a), the "figural" category has been subdivided into a visual (V) and an auditory (A) category, hence the symbol NVT here rather than NFT as previously.

Some Special Hypotheses Concerning Field Independence

From what has just been said, the conclusion might be that Witkin's FI trait is, in fact, to be identified with SI ability NVT. As such, it would be rather narrow, restricted to the operation of convergent production of visual transformations. There is much evidence that it is, indeed, much broader than that. For example, Karp (1963) reported a factor with not only the vertical-adjustment and embedded-figures tests in common but also in common with the tests Match Problems and Insight Problems. In ARP research, Match Problems was a faithful representative of ability DVT (divergent production of visual transformations) and Insight Problems should measure DMT (divergent production of semantic transformations). These conclusions suggest that FI is sufficiently general to be concerned with divergent as well as convergent production, and with semantic content as well as visual content, so long as transformations are involved.

It was mentioned earlier that high FI status favors development of behavioral abilities. In view of the decision that FI is concerned with transformations, but possibly confined to transformations, possibly only the abilities NBT and DBT in the behavioral area are related. Although there is thus evidence that FI pertains to visual, semantic, and behavioral content, there seems to be none that it also applies to symbolic content. Since the high-FI persons tend to like mathematics, and mathematical thinking is so often concerned with transformations, FI may also be related to symbolic information as well.

There is some evidence that FI is extended to yet another SI operation, that of cognition. Several investigators have reported positive correlations between scores for FI and scores for the Wechsler tests of Block Design. Picture Completion, and Object Assembly. In fact, Vernon (1973) reported that he could not find an FI factor independent of those three tests. It is significant that transformations are a significant feature of those tests, for Davis (1956) found that of all the Wechsler tests, those three had loadings in common on a factor of visualization, or SI ability CVT (cognition of visual transformations). There is no evidence that FI also extends to the operation categories of memory and evaluation, but this relation would not be surprising and should be investigated. It may indeed be that FI pertains to SI transformation abilities across the board; a very broad trait, indeed.

It is not yet clear whether FI is an aptitude trait or a control variable. If it is an ability, it is a very-high-order factor, cutting across both operation and content categories. If it is a non-aptitude variable, it is still a broad trait, with an important connection with the SI product of transformation. It could possibly be both, as was concluded by Wachtel (1972). But Wachtel also remarked that FI tests measure an ability first and a preference trait second. This conclusion is consistent with the common experience that first-order factors have larger factor loadings in tests than do higher-order factors, in this case, NVT versus FI.

As will be seen in later discussions, style traits that are demonstrated on the basis of non-aptitude tests (unlike the FI dimension) seem more like interest or preference variables, but still with parallels with SI categories. It is not unreasonable to expect that certain interests would develop in connection with certain kinds of abilities. There is evidence that, in general, profiles of interest are strongly correlated with profiles of abilities within individuals when appropriate interest and ability variables are used (Guilford, 1959).

Complexity versus Simplicity

Compared with the FI style, other proposed traits in this category are somewhat less delineated and well differentiated from one another. This is true of Complexity versus Simplicity, which will hereafter be called "Complexity." It is generally recognized as a preference for complex conceptions over simple ones. In terms of the structure-of-intellect frame of reference, this naming and defining might suggest relation to the SI product of systems. But operationally it appears related to classes, for the favored tests of it are in the form of classifying tasks.

Broadly speaking, the tested *S* is given a set of items of information in a very broad category and is told to sort them into subclasses, with freedom to use as many or as few as he wishes. If he uses a small number of broader, more inclusive classes, his score is in the direction of simplicity. A large number of small classes is said to indicate complexity.

Some tests commonly used for this trait are like Kelly's Role Construct Reperatory Test (Kelly, 1955). In such a test, *S* deals with a set of given items, e. g., names of his friends or associates or of famous people, or in some cases geometric designs. Items are first presented in sets of three, with *S* to say how two of them are alike but different from the third. Classes are thus formed, to which *S* may add items later. Simple sorting tasks are probably more often used, *S* simply being handed a set of items and told to classify them.

There has been some confusion as to just what constitutes complexity, one important consequence being that a second trait dimension known as "Equivalence Range" is sometimes regarded as the same dimension and sometimes not. It is also commonly demonstrated by means of classifying tests. A difficulty arises from the fact that there are two common reasons for grouping items together. Things are classified together, of course, because they have attributes in common. As some writers point out, e.g., Scott (1962), attributes are of two kinds. Some are in the form of dichotomies or are readily reduced to dichotomies. The items being classified have the attribute or they have not. Other attributes vary continuously along scales, and similarity in this case is a matter of nearness of two items on the same continuum.

If one may speculate a bit, in an individual's comparing two items as to similarity of collections of dichotomous features, it is as if his brain were performing a correlation between the two items, in something like the *G* index of agreement (Holley and Guilford, 1964). This coefficient is a linear function of the proportion of common elements in two things, such as two personalities. In terms of continuous variables, as already mentioned, it is a matter of estimating linear distances, as in making a psychophysical judgment. Some sorting activities could, of course, involve both kinds of judgment of similarity, depending upon the kinds of items to be classified.

But because of the two kinds of judgments, two cognitive-style traits pertaining to classes could exist. Vannoy (1965) has found two such distinct factors. Those who assume that both kinds of tests measure the same trait are probably involved with ambiguous experimental operations and ambiguous conceptions. This is not to say that the two traits are necessarily independent; there may be some correlation between them, thus a single higher-order factor.

In relating the trait of Complexity to the SI model, the belief that it is a matter of complexity of conceptions would suggest that it pertains to units. Units can be more or less complex, depending upon the number of attributes involved. The use of classifying tests is recognized as being incidental in deriving information regarding complexity of the units being classified.

The tests for Complexity do not seem to stay clear of traits pertaining to classes, however. When *S* uses many classes for a set of items, he may be indicating abilities for recognizing or for producing classes. If he does not know (cognize) the class of ideas, of course, he cannot use them. But it is also true that *S* may know the class ideas and is not able to use them. Thus, a number-of-classes score could indicate both an ability and an inclination to use classes. If this is the case, the score is an ambiguous index.

Some investigators vary the classifying task by having *S* sort the same items in more than one way, e.g., Scott (1962). Changes in the set of classes given by *S* could well indicate SI ability DMC (divergent production of semantic classes), if the items were names of things; or DVC, if they were figures; or DBC, if they were personalities. Evidence for abilities of this sort in connection with sorting tests comes from Messick and Kogan (1963). When they scored a sorting test for number of singlets (unclassified items), the correlation of the test with Unusual Uses was −.47 and with Brick Uses it was −.39—for the ability DMC, in this case. The number of singlets thus seems to indicate difficulty in producing alternative class ideas.

As with the FI dimension, there has been some concern regarding generality of the Complexity trait. From the previous discussions it would seem that the trait applies to the products of units and classes, the operations of cognition and divergent production, and possibly to the content categories of visual, semantic, and behavioral. Evidence regarding these three content areas comes from Allard and Carlson (1963). They used a form of Kelly's test with three kinds of items—friends, famous persons, and geometric figures. Intercorrelations among the scores were .67, .59, and .57.

Glixman (1955) used three kinds of verbal statements that can be regarded as representing different degrees of semantic and behavioral information. The statements were about objects, war, and self. He intended to vary the amount of personal reference involved. The intercorrelations were .47, .47, and .56.

Although the consensus seems to be that cognitive styles have more general ramifications in personality, beyond their effects on intellectual functioning, there is little evidence that this is true of Complexity. Glixman (1955) did suggest an element of risk-taking. He observed that in doing a sorting test, *S* is likely to form first a small number of classes, then, sensitive to the risk of error of over-inclusion of items in broad classes, he forms additional classes. But others have pointed out that there is also risk of error in excluding members from classes already formed. How much such elements of risk-taking may contribute to the general trait of Complexity is unknown. It would seem, however, that by operating in opposite directions, risk-taking tendencies would more or less cancel out. A risk-taking style trait that has been derived from other kinds of evidence will be discussed late.

Equivalence Range

As mentioned earlier, Equivalence Range (ER) is another proposed cognitive style that is operationally related to sorting or classifying tasks. Broad versus narrow classes produced is the indicator of personal positions on this dimension, as for the trait of Complexity, but the tests tend to differ in the two cases. The emphasis in this case is on similarity in terms of distances on continuously scaled attributes rather than on dichotomous attributes. Evidence was cited earlier for the existence of two distinct factors.

The nature of the ER trait is indicated by two kinds of tests often used for it. One form of test asks *S* to state estimates of two extreme values for given items on scales of measurement, an average value having been stated. The values might be for length of whales, for the time it takes for a man to run a mile, or for heights of 12-year-old girls. The more extreme the estimates that *S* gives, the greater his ER tendency is thought to be.

Another kind of test presents in turn a number of stimuli varying over a short range, for example, some cards having spots on them numbering near 20. For each card *S* is to say whether the number is 20, a test used by Bruner and Tajfel (1961). The more yes responses *S* gives, the broader his equivalence range is believed to be.

Sorting tests have also been used, as by Gardner (1953). The task might involve similar colors varying in hue, objects varying in size, or figures differing in shape. Gardner demonstrated correlations between such tests and the tendency of individuals to maintain constancies in perception of sizes and shapes of objects seen under different conditions.

Some parallels between ER and SI abilities can be easily pointed out. Logically, tests calling for judgments, as the ER tests have done, suggest the operation category of evaluation. The sorting tests used to demonstrate it suggest the SI product of classes. In the factorial investigation of Sloane, Garlow, and Jackson (1963), particularly, such parallels become clearest. By inspection, most of their tests call for evaluations, of either units or classes; more often classes. Three kinds of content were involved—visual, semantic, and in a few cases, behavioral. Of the three factors that they interpreted, factor II might be EMC (evaluation of semantic classes) and factor III might be EMU (evaluation of semantic units). Factor I, which involved classifications with all three kinds of contents as just mentioned, could be a higher-order ability to evaluate classes. It seems significant that the authors gave "criticalness" as an alternative name for one of their factors. Fredericksen and Messick (1959) also reported signs of a factor in tests of "critical set" that look like tests of evaluation. Whether the reported equivalence-range factors are abilities or are control or perference variables, or both, is not yet clear.

Leveling and Sharpening

The conception of leveling and sharpening goes back to the Gestalt psychologist Wulf (1922), who made some unique studies of memory. He found that as *S*s gave reproductions of figures after periods of retention, there were tendencies to go in either of two directions. Leveling of the figure took the form of smoothing over irregularities, while sharpening showed itself in growing exaggerations of outstanding features.

The idea of a trait of leveling-sharpening grew out of the observation that there are personal consistencies; individuals tend to go in one direction or the other. The same kinds of effects have been observed in the reproductions of stories. In generalizing the conception of the trait, there has been an extension of it, for example, to the glossing over of inconsistencies, the condensing of information and simplifying, on the one hand, versus caricaturizing it on the other.

One characteristic of Leveling versus Sharpening (LS) tests has followed the pattern set by Wulf, that is, exposing *S*s to figures or to stories, with perhaps two recall tests at intervals later. Observers who examine *S*s' products of recall judge them as to degrees of leveling versus sharpening.

One of the prominent hypotheses concerning the trait of LS regards it as a matter of assimilation of perceived information to remembered information. A kind of test that emphasizes this view uses evidence from the negative time error in making psychophysical judgments. *S* is given two successive stimuli, to judge whether the second is greater or less than the first, or standard, stimulus. If a third stimulus is interpolated immediately after the standard, there is a biasing effect on the judgments. If the interpolated stimulus is greater than the standard, the judgment is likely to be biased downward, giving on the average a "negative time error." The leveling theory of this effect is that the perception of the standard stimulus becomes assimilated to that from the interpolated stimulus. Individuals differ in the extent to which time error occurs; more time error is taken to mean more leveling.

Evidence concerning the generality of the LS dimension was offered by Holzman and Gardner (1960). They used scores from tests of memory for both figures and stories, finding evidence that this trait applies to both visual and semantic content. Holzman (1954) determined susceptibility to time error with three kinds of stimuli—visual, auditory, and kinesthetic stimuli, with positive results. Thus, it would seem that the LS trait applies to three kinds of sensory content as well as to semantic information.

The kind of operation involved could be either cognition or memory, or both. Whether LS applies to other SI operations is still to be determined. The SI products emphasized seem to be units (in the recall tests) and relations (in the time-error tests).

Focusing versus Scanning

There has been much interest concerning cognitive-style traits pertaining to attention in one way or another, perhaps the most common one being Focusing versus Scanning (FS). Attention is a matter of preparation for cognition, or for intellectual operations in general, rather than being a modifier of those operations, as is true of other styles. There has been some diversity in approaching investigation of this area because of some complexity of attention itself.

Before research on cognitive styles in general had been initiated, Woodrow (1939) had reported an attention factor, a variable concerned with the degree to which attention can be aroused and maintained. The FS trait, on the other hand, is concerned with a selective function of attention, and the variable is usually conceived as a focused-diffused dimension. Tests for it have usually employed some form of distraction or detraction.

Presumably, any trait of attention should affect any kind of intellectual functioning alike, and there is no apparent indication of any less general attention traits along the lines of SI abilities or categories. There is therefore nothing to say from this point of view.

Analytical versus Global

A few investigators have been concerned with a trait known as Analytical versus Global (AG). Those two terms are actually applied so often in connection with various cognitive styles that there is potential room for confusion. An alternative term for "analytical" is "articulated." These two adjectives are even used in describing Witkin's Field Independence. But, as argued earlier, that trait is better described as a matter of flexibility.

Wachtel (1968) has described the AG trait as referring to differentiated versus diffuse information. Santostefano (1969) cites Kagan with respect to a number of broad characteristics that are said to apply. The analytical person has more distinct images on the Rorschach. He is better able to describe his feelings. He is more active and is persistent in problem solving. He has a higher IQ.

From the name of the trait and from these descriptions, it can be suggested that at its positive pole it is a very general urge or drive to gain information. Clarity of discrimination is demanded. In the SI view, information is that which is discriminated by the experiencing individual. The globally oriented person is at ease without well-discriminated items; the analytical person is not.

In terms of SI categories, the operation is probably confined to cognition, one of five basic operations, but it could cut across all content categories, and possibly all product categories. The existence of such a broad trait would not preclude lower-order AG traits, restricted to one or more information categories. Individuals might more or less specialize their demands for clarity of information.

Other Styles Related to Abilities

A number of less-investigated cognitive styles show possible connections with SI abilities or SI categories. One that Messick (1976) calls "Conceptual Styles" is concerned with categorizing behavior, but is different from two such styles mentioned earlier. This trait (or traits) has been found in sorting tasks by the fact that individuals show tendencies in one of three directions. Some *S*s prefer sorting in terms of attributes, some in terms of relations, and some in terms of inferences. Those choices give a picture of intraindividual differences in preference for units, relations, and implications, respectively, of the list of SI products.

The style of Conceptualization also has something to do with classification. It is shown in the person who tends to take a limited view of attributes of items of information, and to show a rigidity of classes; he is loathe to change classes, or is unable to do so. This disposition clearly describes the person who is low in SI ability DMC (divergent production of semantic classes), although it may extend to other kinds of content as well. It would seem to be the direct opposite of another style that Messick calls Conceptual Differentiation, which describes the person high on DMC. Thus, these two styles may actually be the extremes of one bipolar dimension.

The person who is high on the style trait of Conceptual Articulation, also noted as "conceptual discrimination," is said to prefer sharpened classes, but also on the whole to show preference for relations, where there are options. The two qualities do not seem to hang together logically. The first one might describe a specialized analytical-global trait, the possibility for which was mentioned earlier in connection with the Analytical versus Global style.

A style of Conceptual Integration, with the alternative label of "integrative complexity," immediately suggests the SI product of system. The style involves seeing how "categories or dimensions of information" are related in multiple and different ways (Messick, 1976). This description suggests the operations of cognition and divergent production. The qualification of "conceptual" suggests semantic content. The SI abilities related could be CMS and DMS—cognition and divergent production of semantic systems.

One style seems concerned with preferences among three kinds of content—visual, auditory, and kinesthetic. This apparent intraindividual kind of variation is said to represent modes of understanding, so possibly the trait is connected with cognition only. Perhaps of a similar nature is the suggested style of preference for conceptual versus psychomotor activity, since these alternatives involve semantic content on the one hand and sensory-input content on the other, probably visual and perhaps kinesthetic.

A Converging-versus-diverging dimension is interesting because of its direct reference to the SI operations of similar names. The convergent pole of the style is described by Messick (1976) as a reliance on logical consistency, correct, conventional outcomes, versus the divergent pole of reliance on quantity and variety of output. In this connection, it is interesting that in some ARP research a factor analysis of variables based upon inventory items about liking for different kinds of thinking activities yielded two different factors in this immediate area—for interest in divergent thinking and interest in convergent thinking (Guilford, Christensen, Frick, and Merrifield, 1961). The correlation between total scores for those two factors was about −.3, which does not confirm a bipolar factor. The explanation is probably that in the inventory approach *S*s are given the opportunity to express liking or disliking both kinds of thinking, whereas style tests would call for forced choices between divergent and convergent thinking.

Styles Related to Other Personality Traits

Some authors have pointed out that, aside from the style of Field Independence, there are really few demonstrated relationships of styles to other kinds of personality traits (Fredericksen and Messick, 1959; Messick and Fritzkey, 1963; and Fillenbaum, 1959, for example). In his 1976 list, Messick described a few cognitive styles that seem to have some possibilities of relationships in various nonaptitude directions, however.

In discussing the style called "Scanning," Messick used the expressions "associated with meticulousness" and "concern with detail," both of which describe the nature of the factor of Meticulousness, which is measured by the Guilford-Holley L. Inventory (Guilford and Holley, 1953).

It can be suggested that the Risk-taking style, with its quality of willingness to take chances and to venture responses, should be substantially related to the factor of Self-confidence, which is one of the traits of the Guilford-Martin Inventory of Factors GAMIN (Guilford and Martin, 1943), also related to the motivational factor of Need for Adventure, of the DF Opinion Survey (Guilford, Christensen, and Bond, 1956).

A style described by Messick as a tolerance for unrealistic experiences, or a readiness to accept unconventional ideas, also as little need to stay close to reality or convention, seems conceptually close to the author's trait of Interest in Autistic Thinking (Guilford, Christensen, Bond, and Sutton, 1954). It is measured as a trait in the DF Opinion Survey, which was just mentioned.

Messick mentions a style of Reflection versus Impulsivity, which seems to have possible relation to a certain temperament factor and also to two different SI abilities, all in one. When he states that an impulsive person tends to give the first idea that comes to him, in contrast with the reflective person, who considers alternatives, this describes the first-order factor of Thoughtfulness of the Guilford-Zimmerman Temperament Survey (Guilford and Zimmerman, 1949). On the other hand, it is possible that this style represents the second-order factor of Introversion-Extraversion, which rests upon the same trait of Thoughtfulness (T) plus the factor of Restraint (R) (Guilford, 1977b).

When Messick states concerning this style that it is concerned with the production of alternative hypotheses, he could be referring to the SI ability DMI (divergent production of semantic implications). Producing a hypothesis is a matter of formulating information that is implied by known information. When Messick states further that there is testing of these generated hypotheses, he is implying that the parallel ability EMI, in the operation area of evaluation, is involved. Some connection in behavior between these two SI abilities and the temperament trait T or with the TR composite is quite reasonable.

Discussion

Kinds of Styles

Considering the preceding remarks concerning the various cognitive styles (referred to frequently hereafter also as CS), it appears that there are actually a number of different kinds of dimensions involved; they are clearly not all of the same breed. This limited survey has brought out some ideas concerning the degree of generality of these traits, where generality means the pervasiveness of manifestations of traits in behavior. The alternative general category name suggested at the beginning—intellectual executive functions—applies to many of them but not to all. The label of "intellectual styles," however, would be more appropriate, since the traits go well beyond the one SI operation of cognition.

As one general alternative, it is possible to consider some CS traits as identifiable with known ability factors or to other personality-trait factors. One example was the possible identification of Field Independence with SI ability convergent production of visual transformations. Conceptual Differentiation was considered possibly identical with divergent production of semantic classes. Other CS traits could possibly be identified as other first-order personality traits, such as Scanning with Meticulousness, and Risk-taking with Need for Adventure.

Another general alternative considered was that some CS traits could be identified with higher-order abilities or other higher-order traits. For example, Field Independence could be a very broad transformation ability, covering any operation or content category. Messick has pointed out such possible higher-order factors within the structure of intellect (Messick, 1973). Other CS traits are concerned with classes in one way or another, e.g., Complexity and Equivalence Range.

It is unlikely that cognitive styles are merely abilities, for many of them definitely appear to represent directions of preferences in information processing, for example. Preference for divergent versus convergent production is an example of a choice between two intellectual operations. In the area of SI contents, there seems to be a competition between semantic and sensory content, as seen in the preference for conceptual versus psychomotor activity. Among the sensory categories there is a style characterized by choices among visual, auditory, and kinesthetic information. A kinesthetic category is not yet in the SI model, but when that area is properly investigated factorially there will probably be a need for it.

Other cognitive styles appear to involve preferences among different products of information. Conceptualizing styles involve favoring units versus classes versus relations as items with which to deal. Conceptual Articulation involves classes versus relations. Conceptual Integration implies a liking for systems, as yet without any particular competing kind of product known to be involved.

One more thing that should be said concerning these preference styles is that they look more like types than dimensions. That is, each represents a profile of interest or motivation within individuals. Concerning these particular kinds of styles, Broverman (1960a) may be right; one might consider using ipsative scores for them.

The many apparent connections between CS traits and SI abilities clearly suggest the value of using the SI model as a frame of reference in investigating styles. It even appears that individuals who have served as subjects have developed some naive conceptions of the SI categories and that this helps to produce cleavages among the styles along SI lines.

Possible Next Steps

These considerations raise a number of questions that can only be answered through future research. In the suggestions that certain CS traits are related to certain abilities, the kinds of connections are not yet clear. Are the connected pairs actually identical on a one-to-one basis? Or do CS tests and possibly also SI tests measure both kinds of traits? Most CS traits seem related to more than one SI ability; are they simply higher-order ability factors? In the cases of preference styles, assuming that they are not abilities, does having high status in a certain ability, or combination of abilities, determine that interest develops in the same direction? All these possible associations of different kinds could suggest hypotheses to be investigated.

With the associations extending as far as they do, there should be in the SI model a good source for hypothesizing still other style traits to be investigated. For example, certain CS traits have been found to generalize to cover visual and semantic information and sometimes behavioral. Do they also generalize to cover symbolic information, as in mathematics, or are there special symbolic style traits? With the possibility that Field Independence covers all the transformation abilities, are there also such broad factors for other products, as for implications, for example? Some CS traits seem limited to the operation of cognition, and one pertains to divergent versus convergent production. Are there CS traits similarly confined to other operations? The common cases of CS traits cutting across SI categories suggest higher-order traits. Perhaps a more basic and more urgent question is regarding the existence of higher-order intellectual abilities. One might look for new CS factors in line with such broader abilities.

Those who have urged that in investigating CS traits more attention should be given to intelligence should have been calling for the same kind of studies. In this connection, no one should any longer use IQ scores, for they are highly ambiguous and very limited in scope. In research that involves intelligence, it is high time that we gave up the use of shotguns and replaced them with rifles, and furthermore, with application of practiced marksmanship. An incidental thought in this connection, but not unimportant, is that if an investigation is intended to determine whether any CS trait is to be distinguished from abilities, in correlational studies the use of partial correlations may be in order.

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